Informatics Circle Newsletter Vol. 1

Welcome!

Welcome to the
Informatics Circle newsletter!
In each edition, we will provide you with puzzles, news, a story about a well-known computer scientist, and more...
This time:

Learn to read secret messages,
Try sorting items like a computer
& Hear all about Dr. Margaret Mitchell

Coming to you from the organisers of the **Informatics Circle** events*

Find any words difficult to understand? Find explanations of important words on page 13!

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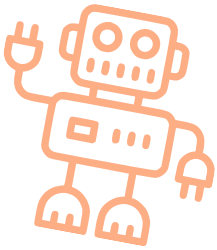
News

Sentient AI



You may have seen some news headlines talking about sentient AI at Google. So what's all the fuss about? Let's break down this phrase first: sentient AI

Sentient means "able to experience feelings"
AI stands for **Artificial Intelligence:** computer models or programmes that learn to mimic human knowledge and behaviour.
Sentient AI = Computer models that have feelings

*computer models are a bit like giant calculators

what happened?

Google made a new computer model that is designed to answer questions. While an engineer tested the model, it gave some answers that made him think the model has feelings!

experts say:

The majority of (computer) scientists disagree. Cognitive scientist and AI researcher Gary Marcus said: **"It's just a good illusion"**.
Dr Margaret Mitchell talked on Twitter about how the model is just really good at mimicking humans.
Learn more about her below!

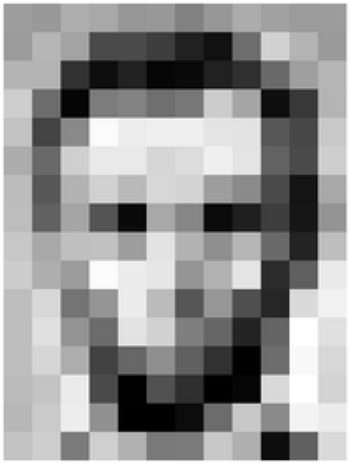
https://www.npr.org/2022/06/16/1105552435/google-ai-sentient?t=1655907791041

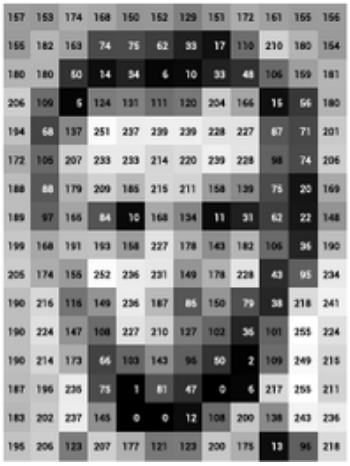
who is:

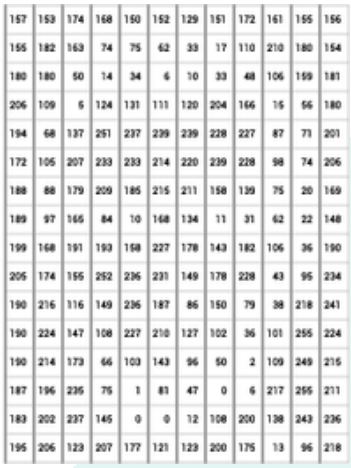
Margaret Mitchell

Margaret Mitchell is a computer scientist studying computers and human language. She's a leading researcher, and she's written over 50 papers - she's even won awards for some of her papers. She's worked for some of the biggest technology companies in the world including **Microsoft** and **Google**.

Margaret did her PhD in **Aberdeen**, not too far from Edinburgh. She worked on making computers **automatically write descriptions** (captions) for images. You would find this task super easy, but for a computer the picture just looks like a **bunch of numbers** so working out what's in the image is very tricky. Margaret's work won a super important award in May.







https://ai.stanford.edu/~syyeung/cvweb/tutorial1.html

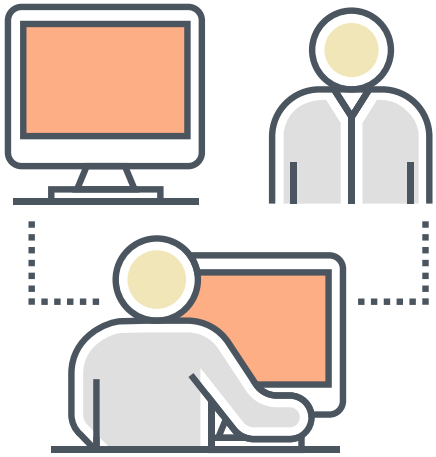
These days, her work focuses on making sure computers treat people **fairly**. For example, think about a computer writing a caption for a picture of a lab coat (like Bill Nye was wearing when she was on his show). We want the computer to be **equally likely** to describe it as "a man's lab coat" as "a woman's lab coat" because **both men and women can be scientists**.

Margaret has founded lots of different projects for making computers more fair, including the Ethical AI group at Google. She currently works for Hugging Face, a company that allows computer scientists like her to share data and software. Her focus is on creating guidelines to make people work more ethically - which is a bit like showing people how to behave well!

Here is an image of England footballer Lucy Bronze. Because men's football gets more attention, most of the images of football being played are of men. A computer trained on pictures of people playing football might caption this picture as "A man playing football" because it is so used to the people in football pictures being men. This is the kind of unfair behaviour that people like Margaret want to stop computers doing.

what is:

the Turing test



Alan **Turing** was a British mathematician and computer scientist. During World War II, he worked on cracking the enemy's secret codes. To do this, he built a machine, the '**first modern computer**'. After the war ended, he kept making better and better computers.

He also wondered if computers would eventually have thoughts like humans. More specifically, **how could we find out if a computer* is like a human?**

*the computers we are talking about here are programmes that have been trained to write something. Instead of a description of an image, it is a reply to a question.

The test!

You have 2 conversations, each lasts around 5 minutes. One conversation is with a human, the other is with a computer, but you don't know which is which. Afterwards you guess! If you guessed wrong, **the computer passed the Turing test.**

Try the Turing test with a friend or family member.. Use paper or a messaging app. You ask questions. They answer as humans, or as they think computers would, or use text prediction. Can you guess which it was?

Hi, how are you doing today?...

puzzle:

Codebreaking

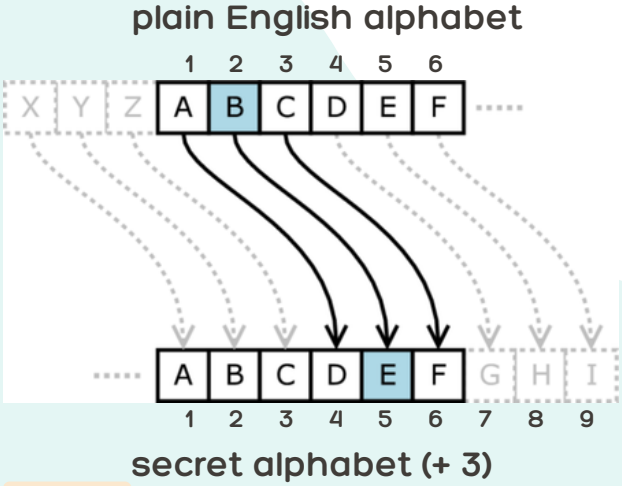
Puzzle time!

You and your friends came across a note written by a stranger.

L KRSH BRX DUH KDYLQJ D QLFH GDB

While you recognise every letter on this note, you've never seen the "words" anywhere before!

Your friend attended an Informatics Circle activity where they learnt about ciphers. They told you that **a cipher is something used to turn plain, normal language into secret code**.
For example: the **Caesar cipher**, which was used by Julius Caesar in his private messages. When making a secret message with the Caesar cipher,
Each letter is replaced with the letter a number of places to its right in the alphabet (written horizontally). This number is between 1 and 25.



The secret message was made with a Caesar cipher, shifting letters by **3** places: every "F" in the message was "C" in English.
Can you work out the rest of the secret message? (Use the exercise sheet, p.8)
If you need some help, check out the table on the next page!

https://kids.kiddle.co/Caesar_cipher

Shifting by 3 places

normal	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
secret	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c

You and your friends start using this Caesar cipher to write secret notes to each other, and soon everyone in your class is doing the same!
Now that everybody knows how to "break" your notes, you want to find a new way to share secrets with your close friends

You can do that by making a **tiny** adaptation to your Caesar cipher 😀
Each letter in the plain text will now be replaced by the letter shifted **10** instead of **3** places to the right in the alphabet.

Using the adapted cipher, what what is the secret version of the sentence on the right? (p.8)

MEET AT THE PARK FRIDAY THREE PM

Shifting by 10 places

normal	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
secret	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j

AOL NHTL PZ ZAPSS OHWWLUPUN AVKHF

You found another secret message written by someone who also used a different number for shifting the alphabet.
<u>How</u> would you figure out what number they used, and uncover the English message?
There's a hint at the bottom of this page, but only check it out after thinking about it for at least a few minutes!

Hint: Instead of trying every possible number, try the short words first!
For example, what is a common three-letter word?
Further hint: it occurred in the last sentence, and in this sentence too! ⟶ "The word is "the"

Puzzle time!

Codebreaking: Exercise sheet

Secret message 1: shift by 3

Secret	**L**		**K**	**R**	**S**	**H**		**B**	**R**	**X**		**D**	**U**	**H**		**K**
English																
Secret	**D**	**Y**	**L**	**Q**	**J**		**D**		**Q**	**L**	**F**	**H**		**G**	**D**	**B**
English																

Secret message 2: shift by 10

English	**M**	**E**	**E**	**T**		**A**	**T**		**T**	**H**	**E**		**P**	**A**	**R**	**K**
Secret																
English	**F**	**R**	**I**	**D**	**A**	**Y**		**T**	**H**	**R**	**E**	**E**		**P**	**M**	
Secret																

Answer key:

Secret message 1: I hope you are having a nice day

Secret message 2: wood kd dro zkbu pbsnki drboo zw

Exercise sheet (continued)

Caesar cipher for secret message 3: shifting by ___ spaces

normal	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
secret																										

Secret message 3

	M	A	X		Z	T	F	X		B	L		A	T	I	I
Secret																
English	X	G	B	G	Z		T	M		Y	H	N	K			
Secret																

WELL DONE!

Answer Key

The alphabet is shifted by 19 places to create secret message 3

Secret message 3: The game is happening at four

Control Flow:

you control the computer!

Control flow is telling the computer **when** and in **what order** to do things.

Control flow is really important so that our computer program does the right thing at the right time.

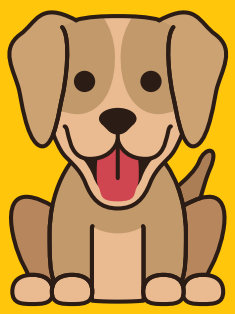
Stranded on the Metro!

One time, a London train stopped in the middle of nowhere, leaving passengers stranded! The train was controlled by a computer program, which used **control flow** to tell the train to stop at certain points. When the train stops changed, nobody changed the program, so the train stopped when it shouldn't have!

Please Feed Sandy!

If you want to give your friend instructions to take care of your dog, what kind of words would you use?

- "While I am away, can you please feed my dog Sandy?"
- "If she cries at the door, then she needs to go outside."
- "If she eats all of her breakfast, then feed her one cup of food for dinner. Otherwise, feed her two cups for dinner."
- "For the next five days, can you please feed Sandy?"



Notice the words we used: "while," "if," "then," "otherwise," and "for." We use almost exactly the same words to tell a computer what to do!

if, then

11

To tell the computer what to do in a certain situation, we use "if, then." Notice that we used this in the example above: "If she cries at the door, then she needs to go outside."

In a computer program, we might write "if, then" like this:

```
› if Sandy cries at door:
›       then let Sandy outside.
```

if, then, else

What now? Add "else" now to suggest another option in case the first situation is not true.

Here, we can use this example: "If she eats all of her breakfast, then feed her one cup of food for dinner. Otherwise, feed her two cups for dinner."

Let's replace the word otherwise here with else:

```
› if Sandy eats all her breakfast:
›       feed Sandy one scoop.
› else:
›       feed Sandy two scoops.
```

What if we wrote this code without "else?"

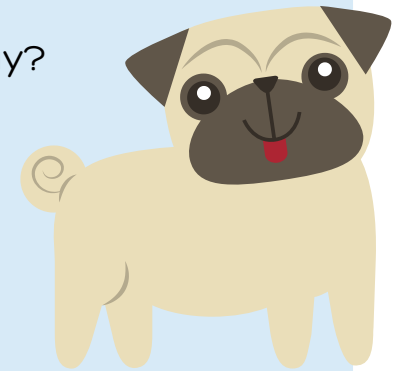
```
› if Sandy eats all her breakfast:
›       feed Sandy one scoop.
› feed Sandy two scoops.
```

What would happen here?

- if Sandy did not eat all her breakfast, the program would run as normal.
- but if she ate all her breakfast, she would get one scoop plus two more scoops: three scoops! This is not what we want.

for

What if we want your friend to do something every day?
We know that you'll be gone for five days.
We can use "for." Let's try it with this example:
"For the next five days, can you please feed Sandy?"



› for each of the next 5 days:
› feed Sandy.

We've told our friend to feed Sandy for the next five days and no more.

GIVE IT A TRY!

For each of the examples below, give what the correct answer should be.

Use a paper and pencil if you need. The answer key is at the bottom of the page!

Program 1:

› if 10 is bigger than 12:
› the answer is 1.
› else:
› the answer is 2.

Program 2:

› for each number from 1 to 10:
› write the number, multiplied by 3.

Program 3 (Challenge):

› for each number from 1 to 10:
› if the number is divisible by 3:
› say "yes"
› else:
› say "no".

Answer Key:
Program 1: 2
Program 2: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30
Program 3: no, no, yes, no, no
yes, no, no, yes, no

Important words!

Artificial Intelligence (AI): computer models or programmes that learn to mimic human knowledge and behaviour. We do this by making pairs of inputs and outputs and turning them into numbers. The computer model then learns to do difficult maths to get from the input numbers to the output numbers (see: Computer model)

Algorithm: a list of instructions for a computer, to solve a particular computational problem. For example, try writing down instructions on how to multiply 2 big numbers (bigger than 10). How did you learn it in school?

Computer model: when a problem is too difficult to make an algorithm for, we need a model. Think of it as a programme or app on your computer that answers different types of questions. We call the questions "inputs", and the answers "outputs". Instead of giving instructions, we show examples of question and answer pairs, which the model learns from.
For example, we could present to the computer many pictures and texts that describe them, to teach the computer how to describe any picture. To compare with an algorithm, try writing instructions to describe any picture (in detail). Do you find that easy?

Software/Hardware: Hardware is the **physical** parts of your computer: the screen, keyboard, battery, motherboard, and so on.
Software is the **programmes** that run on your computer: the internet browser, calendar, MS Word, and so on.
The earliest computers, like the ones Alan Turing made, were really big and could only do one thing: take a secret message as input, and gave the original message as the output. (The Internet didn't even exist yet!)